DESCRIPTION

SURFACE PRESSURE APPLYING DEVICE FOR A SLIDE VALVE

Technical Field

[0001]

The present invention relates to a surface pressure applying device for a slide valve, and more particularly, to a novel improvement for making a surface pressure releasing plate and a surface pressure releasing bar smoothly slide relative to each other by compressing compression springs uniformly, and for reducing weight of parts and enhancing durability of parts.

Background Art

[0002]

A surface pressure applying device for a slide gate described in Patent Document 1 and a surface pressure applying device for a slide valve described in Patent Document 2 can be given as examples of this type of conventional surface pressure applying device for a slide valve.

A common slide valve device is placed at a bottom of a vessel for molten metal, and includes two or three plate bricks with an opening for controlling an outflow of the molten metal by sliding one of the plate bricks. While in use, the plate bricks receive pressure in proportion to the depth and density of the molten metal, but resist the pressure from the molten metal by keeping in close

contact to each other utilizing the repulsive force of distorted springs. It is therefore common that the required spring force amounts to a few to ten-odd tons.

The structure disclosed in Patent Document 1 distorts the springs and thus applies pressure to the plate bricks by making a surface pressure bar and a roller engage with each other.

The structure disclosed in Patent Document 2 relieves the surface pressure with a large-diameter roller which is attached to a surface pressure control bar and climbs over a mountain-like tapered portion formed on the top surface of a surface pressure releasing bar, thus depressing the surface pressure releasing bar and distorting the springs.

[0003]

The structure of Patent Document 1, where the surface pressure bar and the roller are engaged with each other to distort the springs and apply pressure to the plate bricks, cannot avoid insufficient spring distortion which results from the friction between and deformation of the surface pressure bar and the roller. When the springs are not distorted enough, there is a possibility that the pressure applied to the plate bricks cannot withstand the pressure from the molten metal, thus inviting an accident in which the molten metal leaks.

[0004]

In the structure of Patent Document 2, where a large-diameter

roller attached to a surface pressure control bar climbs over a mountain-like tapered portion formed on the top surface of a surface pressure releasing bar, thus depressing the surface pressure releasing bar, distorting the springs, and relieving the surface pressure, the tapered portion on the side on which the large-diameter roller climbs up needs to have as small an angle as possible to reduce the resistance met during the climb. The mountain-like tapered portion formed on the top surface of the surface pressure releasing bar is therefore given an asymmetric shape, making it difficult to match a spring arrangement center with the center between the peaks of two mountains. As a result, different loads are applied to two large-diameter rollers, and the one climbing over the mountain-like tapered portion that is nearer to the spring arrangement center receives an excessive load to be deformed and galled. The deformation and galling could prevent smooth movement.

[0005]

Patent Document 1: JP 08-117985 A

Patent Document 2: JP 2003-200256 A

Disclosure of the Invention

Problem to be solved by the Invention

[0006]

The problem to be solved resides in that smooth movement of the plate bricks is hindered by the asymmetric shape of the mountain-like tapered portion of the surface pressure releasing

bar which makes it difficult to match a spring arrangement center in the lateral direction with the arrangement center between the peaks of two mountains, or by insufficient distortion of the springs or the like.

Means for solving the Problem

[0007]

The present invention is most characterized in that compression springs are distorted with an even force without allowing a shift of a surface pressure releasing bar to move engagement points with projections by making a spring arrangement center coincide completely with a projection arrangement center.

Effect of the Invention

[0008]

A surface pressure applying device for a slide valve according to the present invention makes a spring arrangement center coincide completely with an arrangement center around which projections formed on surface pressure releasing plates are arranged, and at the same time prevents a shift of a surface pressure releasing bar from moving engagement points with the projections. This enables the surface pressure applying device to distort the compression springs always with an even force, so that surface pressure is applied to and released from plate bricks steadily without fail.

In a case where the projections are constituted of rollers, the present invention makes the surface pressure releasing bar slide

more smoothly.

The surface pressure releasing bar can slide smoothly also because an upper roller placed on a lower surface of a housing is in slidable contact with the surface pressure releasing bar.

Brief Description of the Drawings

[0009]

[FIG. 1] A sectional view showing a surface pressure applying device for a slide valve according to the present invention. (Embodiment 1)

[FIG. 2] A side sectional view of FIG. 1.

[FIG. 3] A sectional view showing another mode of FIG. 1. (Embodiment 2)

[FIG. 4] A side sectional view of FIG. 3.

[FIG. 5] A sectional view showing still another mode of FIG. 1. (Embodiment 3)

[FIG. 6] A side sectional view of FIG. 6.

Best Mode for carrying out the Invention

[0010]

An object of making a spring arrangement center coincide completely with a projection arrangement center and distorting compression springs with an even force so that surface pressure is applied and released smoothly has been attained by forming a tapered wedge portion formed in a surface pressure releasing bar and projections on surface pressure releasing plates.

Embodiment 1

[0011]

Reference numeral 1 of FIGS. 1 and 2 denotes a housing that is fixed to a bottom surface of a molten metal vessel 2 such as a ladle. Below the housing 1, clamps 3 are placed on each side of the housing 1 in a manner in which the clamps 3 can be opened and closed. Inside the clamps 3, a slide case 5 is provided which is movable in a vertical direction and connected to plate driving means 4.

[0012]

The housing 1, the clamps 3, and the slide case 5 form a space 6 in which a first plate brick 7 and a second plate brick 8 are installed such that one constitutes the upper layer of two layers whereas the other constitutes the lower layer. The first plate brick 7, together with an upper nozzle 9, is fixed to the housing 1 side. The second plate brick 8 is driven to slide by the plate driving means 4.

An upper nozzle hole 9a opened in the upper nozzle 9 is communicated with a lower nozzle hole 10a of a lower nozzle 10, which is placed in a lower portion of the slide case 5, through a first nozzle hole 7a and a second nozzle hole 8a, which are opened in the first and second plate bricks 7 and 8.

[0013]

A spring holder 12 for holding plural compression springs 11

as surface pressure applying springs is placed on each side of the housing 1 along a longitudinal direction of the housing 1. A surface pressure releasing plate 13 is placed underneath the spring holder 12 in a manner in which the surface pressure releasing plate 13 is movable in a vertical direction integrally with the spring holder 12.

Formed on the top surface of the surface pressure releasing plate 13 are a pair of projections 14 which have at least semicircular surfaces and are distanced from each other in the longitudinal direction.

[0014]

An elongated surface pressure releasing bar 15 is inserted between the housing 1 and the surface pressure releasing plate 13 in a slidable manner. A tapered wedge portion 16 is formed on a lower surface of the surface pressure releasing bar 15. The wedge portion 16 is in slidable contact with the projections 14, thereby allowing the spring holder 12 to move up and down.

[0015]

An arrangement center (A) around which the peaks of the projections 14 are arranged and an arrangement center (B) around which the compression springs 11 are arranged (or, which corresponds to the position of one of the compression springs 11 that is located at the center in the longitudinal direction of the spring holder 12), coincide with each other, and the sliding motion of the surface

pressure releasing bar 15 does not shift the position of the arrangement centers A and B since the engagement points with the wedge portion 16 are the projections 14. Accordingly, the compression springs 11 can be compressed with an even force as the surface pressure releasing bar 15 slides thereon.

[0016]

A surface pressure applying hook 20 for clamping each clamp 3 is provided on each side of the spring holder 12 in a manner in which the surface pressure applying hook 20 can rotate about an axial supporter 21. The surface pressure applying hook 20 is engaged with the clamps 3 when surface pressure is applied to the plate bricks 7 and 8, whereas the surface pressure applying hook 20 is disengaged from the clamps 3 when the surface pressure is released.

[0017]

In the structure described above, the plate driving means 4 is operated such that the second plate brick 8 alone slides while the surface pressure releasing bar 15 is disconnected from the plate driving means 4 by removing a detachable connecting pin 22. This makes the second nozzle hole 8a offset from the first nozzle hole 7a, thereby changing the relative position of the nozzle holes 7a and 8a and controlling the flow rate of molten steel.

The surface pressure releasing bar 15 is slid while being connected to the plate driving means 4 by the connecting pin 22,

and the surface pressure releasing plate 13 is lifted or depressed by the surface pressure releasing bar 15, thereby making it possible to release or apply surface pressure.

[0018]

Next, FIGS. 3 and 4 show another mode (Embodiment 2) of the mode disclosed above with reference to FIGS. 1 and 2. In FIGS. 3 and 4, the projections 14 provided on the surface pressure releasing plate are constituted of rollers whose perimeter has a circular shape. The rest is the same as in FIGS. 1 and 2. Components identical to those of FIGS. 1 and 2 are denoted by the same reference symbols and the explanations thereof are omitted.

[0019]

Next, FIGS. 5 and 6 show still another mode (Embodiment 3) of the mode disclosed above with reference to FIGS. 1 and 2. In FIGS. 5 and 6, a pair of upper rollers 30 are formed on a lower surface 1a of the housing 1 in a rotatable manner. The upper rollers 30 are positioned in opposition to the projections in a manner in which the upper rollers 30 is in slidable contact with the surface pressure releasing bar 15.

The rest is the same as in FIGS. 1 and 2. Components identical to those of FIGS. 1 and 2 are denoted by the same reference symbols and the explanations thereof are omitted.

Industrial Applicability

[0020]

By matching a spring arrangement center with a projection arrangement center, compression springs are distorted with an even force, sliding of a surface pressure releasing plate and a surface pressure releasing bar relative to each other is made smooth, and the weight of parts is reduced and the durability of parts is enhanced. The present invention is also very useful for smooth feeding of molten steel from this type of molten metal vessel.